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Climatic Change, Drought and Dust Crisis in Iran

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***Abstract*—**Drought is a phenomenon caused by environmental and climatic changes. This phenomenon is affected by shortage of rainfall and temperature. Dust is one of important environmental problems caused by climate change and drought. With recent multi-year drought, many environmental crises caused by dust in Iran and Middle East. Dust in the vast areas of the provinces occurs with high frequency. By dust affecting many problems created in terms of health, social and economic. In this study, we tried to study the most important factors causing dust. In this way we have used the satellite images and meteorological data. Finally, strategies to deal with the dust will be mentioned.

***Keywords*—**Drought, Environment, Dust.

I. Introduction

DUST storm is harmful phenomena in desert lands. This is common in arid and semiarid climate, like Middle East. [2]

Dust storms are more severe in this region. Sometimes reduce the horizon to 200 meters. In recent years, severe climatic changes occurred with urbanization and industrialization. Drought and air pollution are the results of these changes.

Air pollution is a mixture of gases and particles which alter the air quality [1]. Causes of this pollution include:

1. Natural and Unpredictable factors: geographical factors, geology and climate factors
2. Artificial and controllable factors : improper human activities

Dust storms are important parts of air pollution resources, Phenomenon that occurs in large areas of Iran in recent years. Conditions in neighboring countries (Saudi Arabia and Iraq) will convert them to produce dust. [1] Other factors have exacerbated the dust. Factors such as: persistent drought, reduced rainfall, lower relative humidity environments, uncontrolled use of water resources in desert areas, loss of canebrake and war.

These factors have led to the wetlands and lakes of east Syria and Iraq are dry and Spread of dust storms is the result. [1]

Previously there were dust storms in spring and summer and in the west of Iran. But now their survival is about eight months of the year. And its impact zone extends to the center and south of Iran. The dust has caused many problems for the residents of these areas and threatens their health. Dust has impaired social, economic and agricultural activities in these areas. Iran and neighboring countries are shown in Fig 1. [5]

Fig. 1 Iran and neighboring countries

Dust affecting a large part of Iran. So in this article we have tried to investigate the causes of dust, how it spread, and factors in its decline.

II. DISCUSSION

Dust in the desert is a natural process and Occurs in all desserts, such as Saudi Arabia - Iraq - Kuwait and parts of southwest Iran. Blowing dust in desert occur in a monsoon and warm seasons. Light vegetation and low rainfall is the profile of this desert.

Iran is located on the arid belt. More than half of the country's land area is arid and semiarid climate. 18 provinces and 82 cities have been identified as a critical focus of wind erosion.

Provinces like: Khuzestan, Ilam, Bushehr and … [1]
In these areas, dust storms occur seasonally. Dust has been continuing for several days and very fine particles can be lifted to a height of 900- 1800 meters. Because the particles are small and light, long time hope to be suspended and are scattered in large areas with speed 40-80 km per hour.

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The fine dust particles become haze when they are mixed with urban pollutants. [3] They will be sticky due to organic material being impregnated. So stick on the device, and can cause pollution and damage to electrical appliances and industrial. Infectious diseases and allergies are also common.

If these particles are associated with radio active materials, can be dangerous for people who are several days in contact with dust. Unfortunately, due to war in Iran (1980-1988) war in Iraq and the chemical bombardment.

Unfortunately, due to war in Iran (1980-1988) war in Iraq and the chemical bombardment, the soil is contaminated with heavy metals. In this atmosphere, there are still traces of radioactive elements. For this reason the possibility of dust contamination that entered the Iranian cities is high.

III. Factors in the Emergence of Dust

Analyzing the time, place and manner of dust storms in the Middle East (especially Iraq); many factors are known to cause dust.

A. Environmental Factors

a. Climatic factors

Factors that create dust in the Middle East and Iran: During rainfall, high evaporation rate, inadequate rainfall, frequent and relatively high wind speed, the short return period of drought, vast areas with dry climates, global warming and the ongoing drought. Due to the warm and dry winds from the deserts of Arabia to the south of Iraq, the marshes and small lakes are drying.

These areas have become dry as dust production center. One of the most important producer of dust, Shamal monsoon winds in Iraq. Shamal winds due to high dynamic power could raise the huge amount of particles from the surface. [3]

And took them to heights of 2400-3000 meters suspended. These particles include quartz, calcite and gypsum, which can remain suspended in the atmosphere up to 10 days at low humidity.

Wind Shamal, with large air masses form in the highlands of Iran, Saudi Arabia and Turkey will interfere. Due to the pressure difference between the eastern deserts of Iraq with West and South parts of Iran, the winds will change to the Persian Gulf and Iran. Due to the pressure difference between the east deserts of Iraq and West of Iran, the winds will change to the Persian Gulf and Iran. The huge masses of dust in summer and winter within 12 -72 hours are transferred to Iran.

b. Geological factors

Formations in the Middle East are very alkaline and evaporate. They have little resistance against water erosion and wind. Like the vast desert in Saudi “Robea Alkhaly”. Satellite images show that the origin of dust in Iran is the following:

Roughnesses in the vast Sahara “Robea Alkhaly” - the Red Sea coast - the dried zones and “Horolazim” salt marsh in Iraq.

Sahara “Robea Alkhaly” was 700 thousand hectares and is composed of clay. This is the desert on the border of Iran, Saudi Arabia and Kuwait. But drought and water shortage, caused dust storms by winds. [5]

About 500 million tons of dust can be released into air by “Robea Alkhaly” storms annually.

Desert particles move to the rotation, pass from the Persian Gulf and then into Iraq. While in Iraq, they dry the “Horolazim”, Tigris and Euphrates floodplain which subsequently increase the severity as they arrive in Iran.

The beds of lakes and swamps have a high percentage of fine grained clay sediments. Like the swampy “Horolazim” and "Al Jsrh" in Iraq. Map of dust distribution centers between 1999-2009 are shown in Fig. 2. [5]

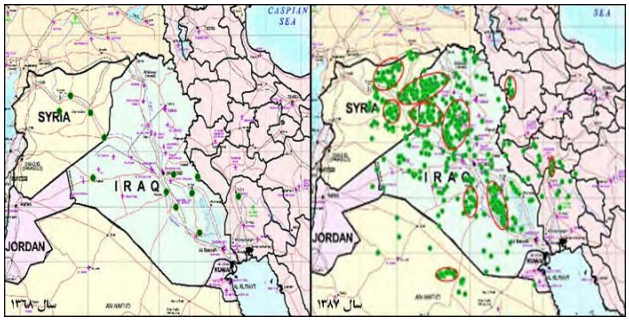

Fig. 2 Map of dust distribution centers between 1999-2009

The environmental factors that were mentioned in most Middle Eastern countries like Iran are causing the formation of dust storms. The number of seasonal storms increase with the wind flow.

A spatial distribution of dust in the center between 1989 and 2009 is reviewed up. In the years 1994-1989 the dust springs are only 14. While in recent years their number has increased to more than 50 associations. [5]

New satellite images of dust storms to Iran are shown in Figs. 3-5. [4]

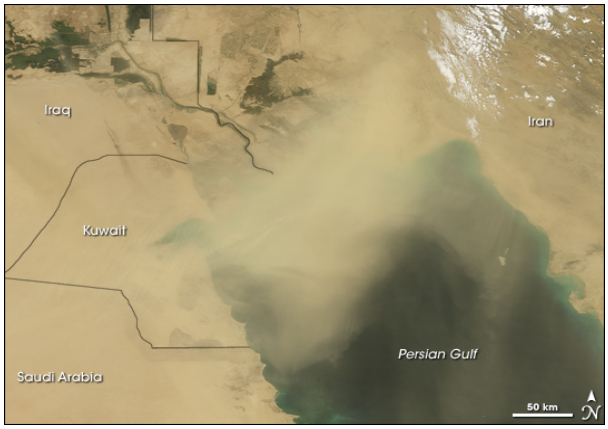

Fig. 3 Dust storm NOAA satellite image

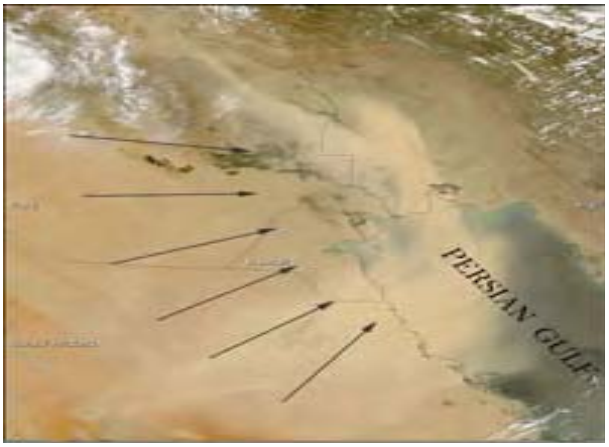

Fig. 4 Dust storm NOAA satellite image

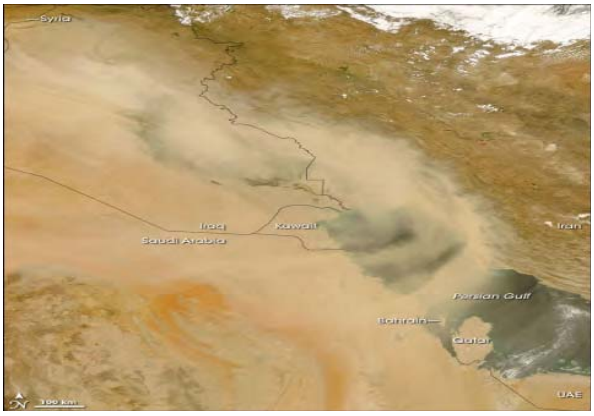

Fig. 5 Dust storm NOAA satellite image

Another point that should be noted is the type of soil dust. There are two types of clay and silt (quartz). Clay soils are lighter and can extend the distance to the dust. For the following reasons clay soils are more dangerous from silt (quartz): clay high Ability to attract organic and inorganic chemicals and fine texture.

Soil silt (quartz) (quartz) is coarser and Adsorption capacity is less. Both types of particles (silt and clay) have a high potential to absorb heavy metals such as iron, copper, zinc, lead, cadmium, nickel, cobalt, thorium, uranium and arsenic. Along the way, can absorb organic and inorganic pollutants and transfer them to distant locations. Despite the high levels of bacteria and pollen have also been reported.

There is a possibility of dust contamination with chemical, biological and radioactive factors. For example, the amount of elements like uranium, thorium, arsenic, lead, zinc, nickel and cobalt in these samples is slightly higher than normal. Given the frequent use of biological weapons, chemical and Depleted Uranium by the Iraq war and America is not surprised there's pollution.

B. Human Factors

Study of dust storms in Iran shows that human and artificial factors in this phenomenon and its persistence are involved. NOAA Research Center study in Iraq has indicated that the main cause of severe dust storms in Iran is desertification in central and northwestern parts of Iraq. Al Jsrh region in Iraq and entering dust to Iran are shown in Fig. 6 [4].

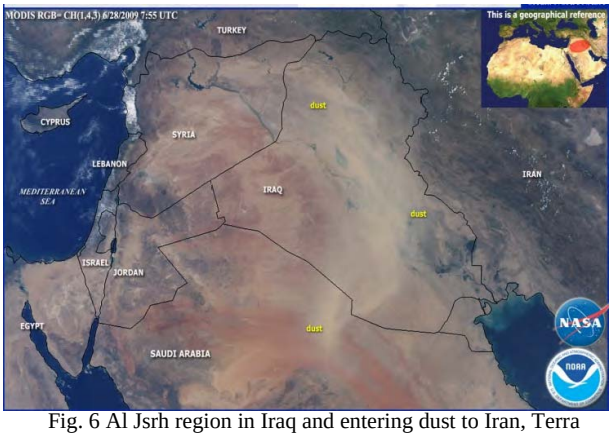

Fig. 6 Al Jsrh region in Iraq and entering dust to Iran, Terra satellite image.2009

In the past this region has been a lot of wetlands and lakes. However, persistent droughts have begun in 1991. The following factors have caused the drying lakes and wetlands: Reduced rainfall, lower humidity, water divisions by a man, dam construction and the indiscriminate use of river water for agriculture.

With the drying up of water, destroyed vegetation and canebrake. Particle bed, lakes and wetlands that are fine (clay size) are easily suspended in the strong monsoon winds. And create a storm in the surrounding areas. [5]

Other human factors are both Iraq - Iran war and Iraq – America war. Due to war, agricultural land and palm groves were abandoned. Areas with suitable vegetation had an important role to avoid creating dust storms in the South of Iran and East of Iraq.

With the loss of vegetation coverage, preventative natural storm barriers were removed. Another factor is the lack of cooperation with neighboring countries that are involved with the dust. In the past, three countries Iran, Saudi Arabia and Iraq would jointly pay costs mulching dry areas. But changing the practices of governments to deal with dust, it is not done. Other factors that influence the creation of dust can be mentioned the following:

Population growth, industrial development, increases the number of factories and industrial facilities, uncontrolled groundwater withdrawals, and the authorities disregarded the risk of drying wetlands and lakes.

IV. CONCLUSION

Overall, the destructive influence of environmental factors associated with human factors, has increased dust storms.

Due to the high desert area, Iran is located in areas with high wind erosion and dust storms. With regard to environmental and human factors mentioned, the conditions for stable dust and sand storms in the area are well provided.

The main cause of dust created in the Middle East, is a global droughts and annual precipitation decreases. Loss of vegetation and desertification in Iraq, are from other causes. Equally important is the prevention and management of this phenomenon.

According to statistics provided by the weather, droughts are likely to continue in the coming years. The most important points at this time are: drought management, prevention of dust excess and appropriately methods of dealing with it.

Therefore, in order to reduce economic, social and health losses of this phenomenon offered the following guidelines:

1 - A coherent and practical plan for drought management in the country and assigned a separate and specific program to deal with dust in provinces that are involved in this phenomenon.

2 - Short-term program is designed to prevent dust penetration, to stabilize the sands in the west of Iran and planting of forests with the participation of the people and government agencies and in the long run, doing Green Belt project around the West of Iran.

3 - Mulching on the sand dune. Mulch does not allow the wind to move the sand, with creating a coating. And mulch acts as a shield for soil moisture and prevents it from evaporating.

4 - Continuous monitoring of weather conditions, careful examination of environmental change and establish a special research center. Finally, the system predicts a rapid evaluation of dust being created.

5- Health promotion projects including:
a. Public Information, Distributed brochures and held classes to maintain people's health when the dust

b. Design, production and distribution of appropriate dust mask.

c. Distribution milk in contaminated provinces and advised people to drink milk

6 - Careful and complete evaluation of the dust by the government, in terms of their chemical composition. Although the amount of nuclear, chemical and microbial contaminants in the dust is negligible, but the dust-affected provinces are providing agricultural products. Negligible contamination entering the food chain could create great dangers for the health of people. In the end we said:
The consequences of this phenomenon in Iran can be reduced to normal with the relevant experts and authorities in support.

To contain the crisis that's already happened in the Middle East, transnational cooperation is the only way. The Persian Gulf countries should cooperate to resolve regional and environmental problems. The cooperation and interaction to maintain the stability of the land can create the interface for the continued friendship between countries.

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